SPALLATION NEUTRON SOURCE
PROJECT ASSESSMENT REPORT AND ACTION PLAN

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1.0 EXECUTIVE SUMMARY

The Spallation Neutron Source (SNS) is a $1.36 B project to build what will be the world's most powerful research facility for neutron science. As a seven-year construction project supported by the Department of Energy (DOE), the SNS is now in its first year of congressionally approved line-item funding. In January 1999, the DOE reviewed the project's status and recommended that experienced project leadership be recruited to strengthen project performance. With the support of the DOE and the five national laboratories[1] participating in the project, the new SNS leadership has conducted a thorough project assessment and developed a comprehensive course of action for completing the project safely, on budget, and on schedule.

The assessment determined that many qualified people and adequate management systems are in place throughout the partner laboratories to support the current R&D activities of the project. The present accelerator concept is sound, uses existing, low-risk technology, and is highly likely to achieve the desired performance and reliability. High-quality technical work is ongoing. Planning for safe execution of the project within the Integrated Safety Management systems of all the partner laboratories is advanced. The final Environmental Impact Statement has been submitted to DOE and approved, and the Record of Decision is expected in May.

As the project enters the Title I design phase, the primary needs identified by the project assessment are to recruit additional experienced staff for key positions, optimize and fully integrate the technical design, and strengthen the business and project management systems to support construction activities. Through prompt implementation of the management action plan developed from the assessment, the project will establish within the next six months or sooner:

1. An integrated SNS organization with experienced people in key roles, fully engaging the expertise available from the partner laboratories;
2. An optimized project baseline, with adequate contingency, that delivers maximum scientific output within the $1.36 B budget;
3. Strengthened Memoranda of Agreement (MOA) that formalize accountability for deliverables, ensure project authority over all project personnel at partner labs, and cap overhead rates;
4. Fully integrated and efficient project and business management systems to plan, track and expedite work accomplishment, and effectively control the project.

Completion of the action plan will position the SNS to be constructed safely and within budget by FY 2006. In full operation the SNS facility will meet or exceed its performance goals and deliver pulsed neutron beams of unprecedented power and reliability to a world-class instrument suite.

[1] The preferred site for the SNS is at Oak Ridge National Laboratory (ORNL) and essential technical expertise is being provided by Argonne National Laboratory (ANL), Brookhaven National Laboratory (BNL), Lawrence Berkeley National Laboratory (LBNL), and Los Alamos National Laboratory (LANL).

2.0 INTRODUCTION

For 30 years there has not been a major new neutron source commissioned in the United States. This situation has led to a serious decline in the competitiveness of U.S. researchers compared to their European and Japanese colleagues. Lacking new opportunities, successive generations of young neutron scientists have migrated into other fields of research, significantly depleting the strength of an enterprise in which North America played *the* seminal role as recognized by the 1994 Nobel Prize in Physics. Although decline within the U.S. neutron research community has occurred, global neutron research has expanded its unique role in determining the structure of critical materials, especially complex magnetic and organic substances which are essential to our high-technology economy. Given the growing age of existing U.S. facilities and the compelling scientific importance of neutrons, the construction of a leading-edge neutron research facility has become an urgent national priority.

The U.S. neutron research community has now focused on reestablishing world leadership in this critical field by building the Spallation Neutron Source at the preferred site of ORNL. Using advanced accelerator technology, and at a cost of $1.36 B, this source will be ten times more powerful than any existing facility worldwide when it is completed in FY 2006. Including new-generation neutron-source technology and instrument design, the SNS will extend its scientific advantage to an even greater level. Success in achieving these challenging technical goals can only be accomplished through exemplary cost, schedule, and safety performance.

The DOE regularly reviews its major construction projects using a comprehensive approach that has an outstanding reputation for depth and integrity. During January 26-28, 1999, the DOE conducted such a review of the SNS project, which has its first year of construction line-item funding. The purpose of this review was to validate the project's proposed Level 1 (Office of Science) cost, schedule, and technical baseline. The review determined that the project planning was not sufficiently mature to support the validation of the necessary baseline and recommended that experienced project leadership be recruited to ensure the project could be executed successfully. In early March, Dr. David Moncton — previously the leader of the recently successful Advanced Photon Source project — was appointed. With the support of DOE (Appendix A) and the five DOE laboratories participating in the project, he has attracted other experienced managers, enlisted independent specialists, and conducted a rapid assessment of every aspect of the project to determine the assets, status, and the course of action necessary to establish the baseline and complete the project successfully. Part of this assessment considered whether the project's scope was optimized to provide the greatest capability for neutron science that could be obtained within the budget of $1.36 B.

Informed by this assessment, DOE review reports, and its collective experience with major scientific projects, the new SNS leadership developed the action plan summarized in Section 4 below. This plan contains the actions, milestones, and strategies needed for the balance of FY 1999 to position the SNS for success in meeting its performance objectives.

The SNS project has a great deal of work to accomplish in a short period of time. But there exists within the DOE system, and available to the project through the five-lab collaboration, expertise sufficient to achieve all the long-range goals of the project and build a facility that will

revolutionize neutron scattering worldwide. This facility will reestablish the U.S. as the premier center for neutron research, and its safe construction, on schedule and within budget, will clearly demonstrate the commitment and the capacity of the DOE national laboratories to achieve world-class management and scientific performance.

3.0 PROJECT VISION AND MANAGEMENT PRINCIPLES

The key element in the SNS project planning is the formation of an effective multi-laboratory partnership to insure that the best scientists/engineers and the optimum technology are employed in the design and construction phases with followed by successful commissioning and operation. To execute this project effectively, the participating laboratories must share a common vision for the facility and embrace an active management approach that transcends institutional boundaries. Underlying both of these elements must be a strong commitment to attract and support people who are highly qualified in every aspect of technical and management responsibility.

Vision

By the year 2006, the SNS will have been completed safely, within cost and on schedule by the multi-laboratory partnership. It will be positioned to meet or exceed its performance goals within the ensuing few years, delivering pulsed neutron beams of unprecedented power reliably to instruments with highly advanced designs. Through their involvement in these developments, an expanded user community will advance the frontiers of knowledge in a broad range of scientific fields.

In these accomplishments, the partner laboratories will have met or exceeded their individual goals and enhanced their reputations in areas important to their own competencies. But more importantly the people involved will have achieved something that none of them alone could have done — turning this vision into a reality that will transform many fields of science for decades to come.

Management Principles

Environment, safety and health. Of overriding importance is the safety of our people and the protection of the environment. It is our philosophy that accidents and injuries can be prevented, that we must rigorously adhere to relevant safety and environmental standards, and that no individual working for the SNS project should feel compelled to do work he/she believes is not safe. Managers and workers share this responsibility, and all must work to continuously improve our collective performance.

High-quality people. Our next most important principle is that optimum results will be achieved on this complex project by the best people working in a collaborative and supportive environment.

Integrated, cross-laboratory teamwork. A major challenge in this project is to manage effective collaboration among the participating laboratories. We will need to establish explicit mechanisms to overcome institutional, geographic, and communication barriers and build an integrated SNS team.

Project-based thinking to deliver on time and within budget. It is essential to recognize that the SNS is first a major construction project with specific deliverables and a firm cost and schedule. A key principle for a project of this magnitude and technical complexity is the need to optimize globally — that is, over the entire project — rather than locally. For every project element, the temptation must be avoided to optimize local technology, budget or schedule, whenever doing so would not benefit the project overall.

Active management and clear communication. Management has a fundamental responsibility to make and communicate decisions in an open and logical manner, while achieving the highest possible degree of consensus. It is essential that project employees and managers respect and trust one another, and that the management team act in a way that is deserving of that trust.

Collaboration Management

The most fundamental issue in collaboration management is the nature of the "contract" between ORNL as the lead lab and the other partner laboratories. Because ORNL has the ultimate responsibility for delivering the SNS project and operating the completed facility, it is imperative that ORNL provide credible technical and project leadership on behalf of the collaboration. It is incumbent on ORNL to delegate appropriate authority to the partner labs for execution of their work consistent with their demonstrated performance and the terms of the Memoranda of Agreement. It is equally important that ORNL have full ability to track and appropriately manage SNS activities at the partner labs. In implementing this trust-but-verify approach, it is desirable to have maximally transparent boundaries between the partner labs, thereby creating an integrated project team with accountability and communication as clear as if the project were executed in the traditional single-lab approach.

4.0 ACTION PLAN

Planned actions developed by the new SNS leadership are grouped within six principal categories and are summarized below.

People and Organization

The Project Office will be reorganized by July to establish clear responsibility for each technical and administrative area and increase the number of project-experienced managers (Fig. 1). An accelerator technical staff (led by an experienced Accelerator Systems Division Director) will be promptly established at ORNL to lead integration and review of component and system designs, prepare for facility operations, and guide procurement, fabrication, installation, testing and commissioning strategies. An integrated project human resources plan will be developed (in phases and completed by October) to guide the hiring process. Key staffing needs identified during this project assessment will be filled as soon as possible with qualified and experienced individuals. The HR plan will include policies and mechanisms for ensuring project input into performance appraisals for people performing SNS work, position description requirements, staffing levels, and strategies to ensure that broad diversity in talent is achieved.

SNS Organization

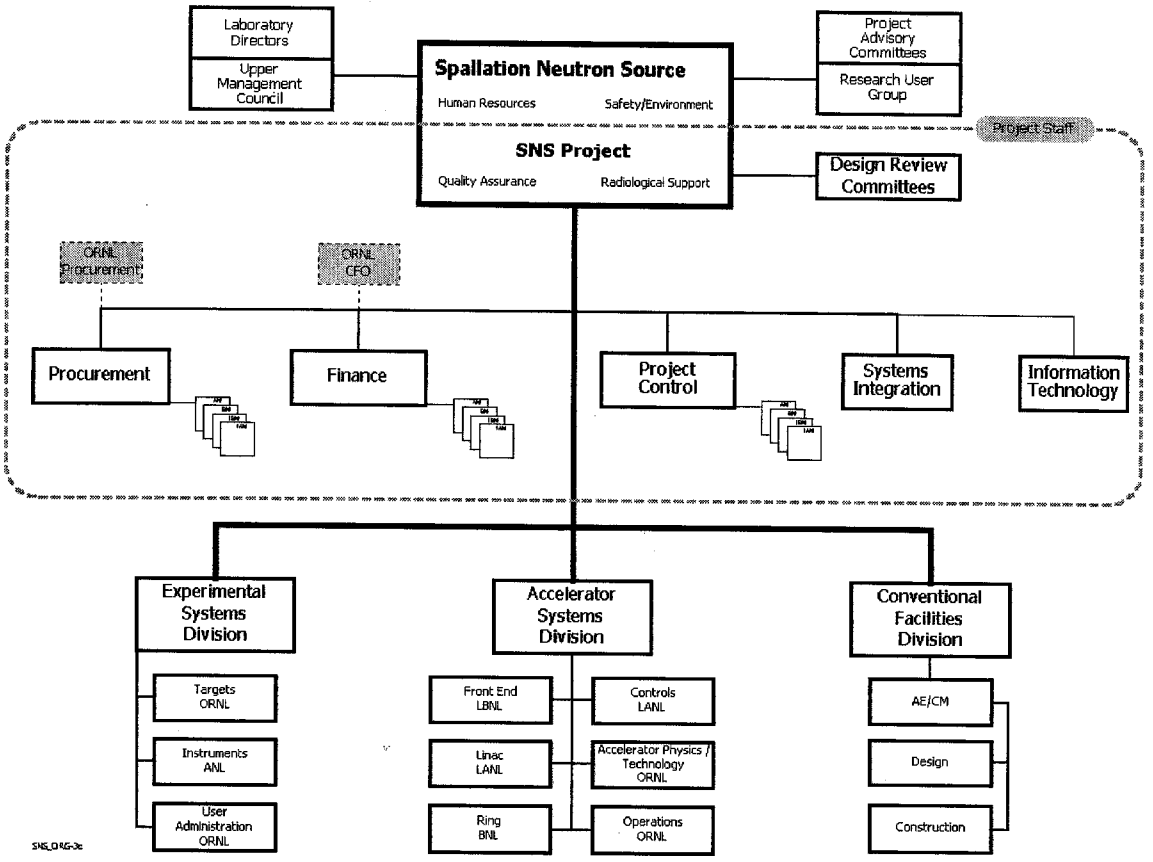

Figure 1

Technical Concept

By August 1999, a plan for SNS instrumentation will be developed that reflects the need for best-in-class instruments, involves the user community, capitalizes on the capabilities of the federally-funded laboratories with substantial neutron science experience, and includes ongoing instrument development. This plan will propose mechanisms and incentives for investment by potential investors, a strategy for engaging the scientific community early in the project, and user access policies tailored to the needs of the neutron scattering community in the U.S. A series of workshops aimed at outreach to new user communities (e.g., the biological/biomedical community) will be launched. Also, by August 1999, a staffing plan for operations, ongoing instrument development, and on-site user activities and support will be developed to optimize the design of the conventional facilities. An R&D program on a backup solid target will be initiated now.

The present linac/accumulator ring (LAR) concept will be optimized for 2-MW operation by May 1999 and its detailed cost estimate will be reviewed and scrubbed by the project management in June. This process will strive to identify available funds to increase project contingency and to provide additional instruments, targets, and office/laboratory space. This 2-MW LAR design will be reviewed by the Accelerator Systems Advisory Committee and proposed as the project baseline to DOE in mid-July. In parallel, a study will be started immediately (provided sufficient resources can be identified) to explore modified accelerator designs by June. If modifications are shown to have substantial cost advantages with no loss of performance or negative impact on the project's long-range schedule, then their designs, cost estimates, and schedules will be developed by October 1999 and adopted through the project's formal change control process.

Conventional Facilities and Site

Full geotechnical qualification of the preferred ORNL site will be pursued aggressively. Innovative technology and a site drilling plan will be employed, and the three-season surveys for threatened species and endangered plants will be completed by the end of calendar year 1999. Facilities programming will be initiated now to ensure that adequate requirements to support researchers and operations staff are identified in the design. Systems requirements documents for all facilities will be completed, and the design requirements and site plan of the Joint Institute for Neutron Science will be reviewed with the University of Tennessee to ensure that the SNS site plan and programmed space needs are optimized. Based on the actions above, the final SNS site qualification will be completed by September 1999.

Project Management

The Memorandum of Agreement with each partner laboratory will be revised by May 1999 to formalize each laboratory's accountability for deliverables, strengthen the authority of the Project Director over SNS-assigned personnel at each location, and cap overhead rates applied to SNS activities for the duration of the project. The role of the project Upper Management Council will be developed to provide additional and regular advice and assistance with strategic collaboration management issues.

Environment, Safety & Health, and Quality Assurance

A focused effort on target radiological issues in the preliminary safety analysis report (PSAR) will be instituted now to support a project decision in June 1999 on target hazard classification and potential mitigation proposals. Completion of the draft PSAR will be expedited to the first quarter of FY 2000. The project ES&H group will issue a draft plan by July 1999 to establish appropriate project-wide ES&H standards for engineering design. A quality assurance (QA) approach will be developed and a tailored QA plan will be approved by September 1999. To facilitate development of this plan and enhance cross-project teamwork, a workshop including QA specialists and technical managers will be conducted.

Business Systems

A number of actions are planned to improve the project's management support systems, including human resources, finance and accounting, and procurement.

With DOE assistance, policies and plans to better facilitate recruitment of experienced personnel will be established to provide continuity of service benefits when hiring between DOE laboratories. Relocation and family assistance to address recruiting concerns at ORNL (including transfer of ORNL personnel hired at partner laboratories) will be procured. Routine use of videoconferencing capability available to SNS project teams at all partner labs will be implemented by July 1999 to reduce travel costs and enhance communications.

By October 1999, methods to automate the integration of financial and cost performance reporting system information with project schedules will be in place, reducing the manual effort currently required to reconcile these data and to provide improved contingency control. The project office will conduct a detailed analysis of overhead rates at all partner laboratories and verify cost estimates during the June cost estimate scrub. This action will support the establishment of long-term capped overhead rates as reflected in the strengthened MOA. An SNS project financial audit plan will be formalized by October 1999, to include plans for regular financial reviews and guidance for audit activity at partner laboratories.

A project-wide procurement strategy will be developed by July; this strategy will include advanced procurement planning, guidance for acquisition decisions, reporting requirements and formats, approval levels, and buyer/technical staff roles and responsibilities. A workshop led by ORNL project procurement will be scheduled to help develop this strategy, build teamwork, and resolve inefficiencies resulting from constraints on procurement organizations in the partner laboratories. Based on the project procurement strategy, the procurement workload and resulting staffing plan will be developed and in place by October 1999.

5.0 CONCLUSIONS

This assessment report and action plan addresses the SNS project's organization, technical, and scientific capability, site qualification, project management systems, business systems, and human resources. The plan focuses on establishing by July 1999:

1. An integrated SNS organization with experienced key staff in place that takes advantage of the capabilities at the partner laboratories, while building at ORNL the technical and administrative strength to lead the construction effort and operate the completed SNS user facility for world-class scientific research;

2. A validated, self-consistent, and optimized technical, cost, and schedule baseline with adequate cost and schedule contingency and maximized neutron-science capability within the $1.36 B budget;

3. Strengthened interlaboratory MOA that formalize accountability for deliverables, ensure project authority over all project personnel, and cap overhead rates for the life of the project.

Major objectives to be achieved by October 1999 include:

4. To complete the geotechnical analysis of the preferred site at ORNL to determine that it is acceptable;

5. To establish a firm hazard category for the target facilities to allow optimal design and planning to proceed and ultimately to allow safe and cost effective operation;

6. To implement fully integrated and efficient project management systems to plan, track, and expedite work accomplishment, and effectively control the project; and

7. To establish financial, procurement, human resource, and related business systems that are tailored to project needs and linked to the project management databases.

The assessment determined that many qualified personnel and management systems adequate for the R&D phase are in place throughout the partner laboratories. High-quality technical work is ongoing. Planning for safe execution of the project within the Integrated Safety Management systems of all the laboratories is advanced. The final Environmental Impact Statement has been submitted to DOE for approval and the Record of Decision is expected in May. The primary project needs are to significantly upgrade the capabilities and systems of the central project office during the design phase, and to fully optimize and integrate the design for construction and operation.

Project management, reporting, business, and human resource systems will also be tailored to execute the project in the multilaboratory environment. These systems will become fully mature by October 1999. The critically important task of developing a staffing plan and attracting highly qualified personnel will proceed concurrently. The Upper Management Council, consisting of one senior line manager appointed by each partner laboratory director, will be convened on a regular basis to assist project management and help refine the collaboration management approach. Successful completion of the described action plan will position the SNS to be completed safely by the multilaboratory partnership within budget and on schedule.

A. DOE Letter of Agreement

Department of Energy
Washington, DC 20585
February 19, 1999

Dr. David Moncton
Associate Laboratory Director
for the Advanced Photon Source
Argonne National Laboratory
9700 Cass Avenue Argonne, IL 60439

Dear David:

Al Trivelpiece told us that the five laboratory directors responsible for the construction of the SNS met and that you were their enthusiastic and unanimous choice to lead the SNS project. I was very pleased to learn that you are seriously considering this position and that you already have agreed to undertake a personal review of the project. I understand and support your need to review all aspects of the project and to discuss your findings and recommendations with both the DOE and the five laboratory collaboration.

We have agreed that you will assemble a Senior Management Team from both within and outside the present SNS project. The Senior Management Team will conduct a comprehensive month-long asset assessment using a set of teams composed of outside experts and internal asset owners. Under review will be, among others things, financial resources, human resources, project management systems, business management systems, physical assets, and the site itself. Importantly, we have agreed that your assessment will include the reference design and its associated costs and schedules. You will prepare a Project Plan containing findings and recommendations by the first week in April and will present this plan to DOE, the directors of the SNS partner laboratories, and the several SNS advisory committees immediately thereafter. A longer-term goal is to have the project ready for a Level 1 baseline review by July 1999.

I want to assure you that DOE is open to accepting a wide range of recommendations subject only to a very few constraints, which we have already discussed. These constraints are the following. (1) The Level 0 Baselines (cost, scope, and schedule) approved by Secretary Pena in December, 1997, and modified only as a result of the FY1999 appropriation must be maintained; within the TPC, there must be an adequate contingency. (2) The SNS project must continue as a five-laboratory collaboration with ORNL as the preferred site. (3) In accord with the recommendations of the Basic Energy Sciences Advisory Committee (BESAC) regarding the technical specifications of the SNS, the design must be sufficiently flexible so that the SNS can be operated at a significantly higher power in a later stage. Furthermore, the upgrade path must minimize downtime for the users. (4) Finally, it is very important that the design maximize

scientific capability through a large and robust initial suite of instruments and through other accommodations to the needs of the neutron science user community.

Other recommendations of BESAC were that the design rely on low-risk technology initially, the linear accelerator design not exclude direct injection of long pulses into a spallation target, and the source have a predictability and reliability as set forth in the Kohn report and be capable of operating at least 240 days annually. You should consider these recommendations as you undertake your assessment of the project.

We have also agreed to work with you and the Laboratory to accommodate needs related to recruitment and retention incentives for the SNS senior management team and other issues. Please let me know if there is anything that I can do to expedite your review. I look forward to your presentation to me and to the Office of Basic Energy Sciences. Again, I want to sincerely welcome you into the SNS collaboration and offer my full support and help during the coming weeks.

Sincerely,

Martha A. Krebs
Director
Office of Science